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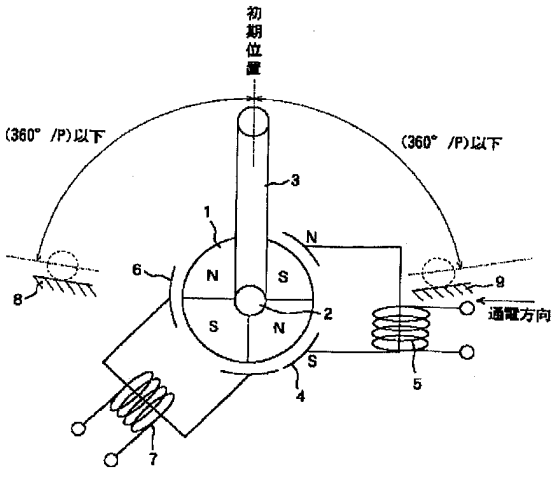
(54)【発明の名称】　光量調節装置

(57)【要約】
【課題】　絞りの位置検出用のセンサーや検出回路を用いずに光量調節が行える光量調節装置を提供する。
【解決手段】光量調節部材と、外周面に多極着磁したロータマグネット１に対して、励磁コイル５，７を備えた一対のステータ４，６を電気角で９０度の位相差を有して対向配置し、前記各コイル５，７に交番電流を通電する事により正逆回転して前記光量調節部材を開閉駆動するステッピングモータと、所定の前記励磁コイルへの通電により決定される前記ロータマグネット１の初期位置を基準として前記ロータマグネット１の機械角を所定の範囲内に制限するストッパー８，９と、を備え、ストッパー８，９は、ロータマグネット１の着磁極数をＰとすると、機械角＜（２×３６０°）／Ｐの範囲に制限した。



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【特許請求の範囲】

【請求項１】　光量調節部材と、外周面に多極着磁したロータマグネットに対して、励磁コイルを備えた一対のステータを電気角で９０度の位相差を有して対向配置し、前記各コイルに交番電流を通電する事により正逆回転して前記光量調節部材を開閉駆動するステッピングモータと、所定の前記励磁コイルへの通電により決定される前記ロータマグネットの初期位置を基準として前記ロータマグネットの機械角を所定の範囲内に制限するストッパーと、を備え、前記ストッパーは、前記ロータマグネットの着磁極数をＰとすると、機械角＜（２×３６０°）／Ｐの範囲に制限したことを特徴とする光量調節装置。

【請求項２】　前記ストッパーにより規制される両方の規制位置は開口面積の異なる第１の開口位置と第２の開口位置とし、前記初期位置を全閉位置としたことを特徴とする請求項１に記載の光量調節装置。

【請求項３】　いずれか一方の前記励磁コイルを前記初期位置設定用に用いることを特徴とする請求項１または２に記載の光量調節装置。

【請求項４】　前記一方の励磁コイルの抵抗値は前記他方の励磁コイルの抵抗値よりも小さいことを特徴とする請求項３に記載の光量調節装置。

【請求項５】　前記一方の励磁コイルに対する制御入力が、前記他方の励磁コイルに対する制御入力よりも小さいことを特徴とする請求項１乃至４のいずれか一つに記載の光量調節装置。

【請求項６】　前記ステッピングモータの制御入力は、絞り値設定時の通電波形をＰＷＭ入力とし、閉じ動作時の通電波形を矩形波入力としたことを特徴とする請求項１乃至４のいずれか記載の光量調節装置。

【請求項７】　請求項１乃至６のいずれかに記載の光量調節装置を有することを特徴とする画像記録装置。

【請求項８】　前記画像記録装置はデジタルカメラであることを特徴とする請求項７に記載の画像記録装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、光量調節装置およびデジタルカメラ等の画像記録装置に関するものである。

【０００２】

【従来の技術】従来のビデオカメラなどに用いられている光量調節装置は、駆動コイルへの通電量により２枚の絞り羽根を開閉動作させるガルバノ方式のアクチュエータと、絞りの位置検知用のホール素子を備えると共に、絞り位置の制御信号を出力する回路を備えたものが公知の技術として広く用いられている。

【０００３】また、画像取り込みの際のシャッター動作時は駆動コイルに逆通電する事で高速の閉じ動作特性を得る必要がある。

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【０００４】

【発明が解決しようとする課題】しかしながら、上記従来例のアクチュエータでは、絞りの位置検出用ホール素子や、ホール素子出力を用いた絞り位置の検出回路や回路調整など部品点数も多く回路も複雑で、高速シャッターを実現するには駆動コイルの抵抗値を下げる必要があるが、通常の絞り値設定時の消費電力も増加してしまう欠点があった。

【０００５】また、このような構成においては、近年デジタルスチルカメラ等に要求される省エネ・小型・安価な光量調節装置を実現する事が困難である。

【０００６】本出願に係る発明の第１の目的は、絞りの位置検出用のセンサーや検出回路を用いずに光量調節が行える光量調節装置および画像記録装置を提供しようとするものである。

【０００７】本出願に係る発明の第２の目的は、絞り値の制御時や絞り設定時の省エネを図り、閉じ動作の高速化を可能とする光量調節装置および画像記録装置を提供しようとするものである。

【０００８】

【課題を解決するための手段】第１の発明は、光量調節部材と、外周面に多極着磁したロータマグネットに対して、励磁コイルを備えた一対のステータを電気角で９０度の位相差を有して対向配置し、前記各コイルに交番電流を通電する事により正逆回転して前記光量調節部材を開閉駆動するステッピングモータと、所定の前記励磁コイルへの通電により決定される前記ロータマグネットの初期位置を基準として前記ロータマグネットの機械角を所定の範囲内に制限するストッパーと、を備え、前記ストッパーは、前記ロータマグネットの着磁極数をＰとすると、機械角＜（２×３６０°）／Ｐの範囲に制限したことを特徴とする光量調節装置にある。

【０００９】第２の発明は、上記第１の発明で、前記ストッパーにより規制される両方の規制位置は開口面積の異なる第１の開口位置と第２の開口位置とし、前記初期位置を全閉位置としたことを特徴とする。

【００１０】第３の発明は、上記いずれかの発明で、いずれか一方の前記励磁コイルを前記初期位置設定用に用いることを特徴とする。

【００１１】第４の発明は、上記第３の発明で、前記一方の励磁コイルの抵抗値は前記他方の励磁コイルの抵抗値よりも小さいことを特徴とする。

【００１２】第５の発明は、上記いずれかの発明で、前記一方の励磁コイルに対する制御入力が、前記他方の励磁コイルに対する制御入力よりも小さいことを特徴とする。

【００１３】第６の発明は、上記第１ないし第４のいずれかの発明で、前記ステッピングモータの制御入力は、絞り値設定時の通電波形をＰＷＭ入力とし、閉じ動作時の通電波形を矩形波入力としたことを特徴とする。

【００１４】第７の発明は、上記のいずれかの光量調節装置を有することを特徴とする画像記録装置にある。

【００１５】第８の発明は、上記第７の発明で、前記画像記録装置はデジタルカメラであることを特徴とする。

【００１６】

【発明の実施の形態】（第１の実施の形態）図１乃至図５に本発明に係る第１の実施の形態における光量調節装置の動作原理を示す。図１において、１は外周面に４極着磁された円筒形状のロータマグネット、２はロータマグネット１に固着された回転軸、３は回転軸２に固着されロータマグネット１と共に旋回するレバーである。

【００１７】４は電磁石の一方の磁極となるＡステータ、５はＡステータ４を励磁して磁力を発生させるＡ励磁コイル、６はもう一方の電磁石の磁極となるＢステータ、７はＢステータ６を励磁して磁力を発生させるＢ励磁コイルで、上記２組みの電磁石は電気角で９０°の位相差をもって配置されている。

【００１８】すなわち、Ａ励磁コイル５とＢ励磁コイル７へ９０°の位相差のある交番電流を流す事により発生する回転磁界にロータマグネット１が同期して回転する２相のＰＭ型ステッピングモータを構成している。

【００１９】８、９はＡ励磁コイル５に←方向に通電した時の初期状態を基準としロータマグネット１の機械角を（（２×３６０°）／Ｐ）以下、すなわちＰ＝４であるから機械角＜１８０°の範囲に制限する第１ストッパー、第２ストッパーである。

【００２０】図２（ａ）は第１ストッパー８、第２ストッパー９の位置から、Ａ励磁コイル５に←方向に通電することにより初期位置に設定できる動作を示す。ここではロータマグネット１に図示する矢印により第１ストッパー８、第２ストッパー９とレバー３が当接する位置関係を代用する。なお、図２の（ａ）に示す第１ストッパー位置および、（ｂ）に示す第２ストッパー位置には例えばＡ励磁コイルまたはＢ励磁コイルへの駆動信号の通電により移動し、その位置で通電を停止したものとする。

【００２１】レバー３が第１ストッパー８に当接している状態において、Ａ励磁コイル５に→方向に通電すると、Ａステータ４の磁極が図２（ａ）に示すようにＮ・Ｓ極に磁化され、図示の回転方向に回転力が生じて初期状態へ復帰する。

【００２２】この関係は、図２（ｂ）に示すように、レバー３が第２ストッパー９に当接している状態から初期状態へ復帰する場合も同様である。

【００２３】したがって、第１ストッパー８、第２ストッパー９で規制するロータマグネット１の機械角が、［（２×３６０°）／Ｐ］以上になると、Ａ励磁コイル５に→方向に通電しても第１ストッパー８、第２ストッパー９から初期状態へ復帰する方向の回転力は生ぜず、逆方向に回転力が生じるため本実施の形態に示すロータマグネット１の機械角を［（２×３６０°）／Ｐ］以下にする必要がある。

【００２４】図３は初期状態からＡ，Ｂ励磁コイル５，７への通電により、ロータマグネット１の回転位置を設定する動作をそれぞれ示す。

【００２５】図３（ａ）→図３（ｂ）

前述のように、Ａ励磁コイル５に←方向（第１方向）に通電すると、ロータマグネット１は初期位置に復帰する。

【００２６】次に、Ｂ励磁コイル７に図３（ｂ）に示すように←方向（第２方向）に通電すると共に、Ａ励磁コイル５の通電をＯＦＦにすると、ロータマグネット１は、図３（ｂ）の矢印方向（右）へ回転し、Ｂステータ６の磁極とロータマグネット１の磁極が対向した❶で示す位置で停止する。

【００２７】図３（ａ）→図３（ｃ）

ロータマグネット１を初期位置に復帰させるために、上述したようにＡ励磁コイル５に←方向（第１方向）に通電する。

【００２８】次に、図３（ｃ）に示すように、Ｂ励磁コイル７に→方向（第２方向と逆方向）に通電すると共に、Ａ励磁コイル５への通電をＯＦＦにすると、ロータマグネット１は図３（ｃ）の矢印方向（左）へ回転し、Ｂステータ６の磁極とロータマグネット１の磁極が対向した❸に示す位置で停止する。

【００２９】すなわち、回転角の位置規制を❶に示す位置と❸に示す位置よりも狭い範囲に設けておけば、３ポジションの位置がＡ，Ｂ励磁コイル５，７の通電条件だけで決定できることになる。

【００３０】図１～図３に示す第１の実施の形態では、励磁コイルの通電は１相励磁で説明しているが、１－２相励磁で行えば、更に停止位置を簡単に増やす事ができる。

【００３１】図４は２相のステッピングモータのＡ，Ｂ励磁コイル５，７の制御入力を擬似正弦波によるマイクロステップ駆動入力とした時の通電波形を示す。

【００３２】レバー３の初期位置はＢ励磁コイルがＳＩＮ１００％の入力となっている時である。

【００３３】初期位置に対して電気角でθ°回転させるには、図の通電波形からわかるように、Ａ励磁コイル５とＢ励磁コイル７の通電量の比を

Ａ励磁コイル＝ＳＩＮ（θ－９０）

Ｂ励磁コイル＝ＳＩＮ（θ）

で求められる比に設定すれば、レバー３の停止位置を略制御する事ができる。

【００３４】また、マイクロステップ駆動波形の分割数は機器の使用状態に応じて選択して決定すればよい。

【００３５】図５は図３の動作説明に対応して光量調節装置に適用した場合の概略構成図である。

【００３６】図５において、１０は２相のステッピング

モータであり、１１はステッピングモータ１０の回転軸２に固着されるレバーで、ステッピングモータ１０に設けられている２個のストッパー１２とレバー１１とでステッピングモータ１０は回転位置が規制される。

【００３７】上記位置規制範囲は前述の機械角＜［（２×３６０°）／Ｐ］に設定されている。

【００３８】ステッピングモータ１０の通電入力は、端子１０ａよりＡ，Ｂ励磁コイル５，７に供給され、その通電方法は、前述と同様であるので詳細な説明を省略する。

【００３９】レバー１１は、ステッピングモータ１０の回転軸２と圧入または接着等により固着されていて、相対移動する１対の絞り羽根１３のそれぞれの肩部に突設した２個所の長溝１３ｃ内に、回転軸２の左右に突設したレバー１１の凸部１１ａが係合しており、レバー１１が回転する事により、直進移動ガイド１５に沿って絞り羽根１３自体を進退移動できるようにしている。

【００４０】閉状態はステッピングモータ１０がＡ励磁コイルの図３（ａ）に示す通電条件により初期位置の状態を決定する。

【００４１】次に、Ｂ励磁コイル７の図３（ｂ）（ｃ）に示す通電条件により絞り開放状態あるいは小絞り状態を決定する。

【００４２】絞り開放は図３（ｂ）に示す通電条件により絞り羽根１３が開動作する事によりレバー１１が反時計方向に回転してストッパー１２で位置規制され、不図示の光学機器の絞り開放径１４で開放状態を設定する。

【００４３】このとき、絞り羽根１３の開口部１３ａの開口は絞り開放径１４よりも大径となっている。

【００４４】絞り開放と絞り全閉との間における絞り状態（小絞り）は図３（ｃ）に示す通電条件によりレバー１１が時計方向に回転してストッパー１２で位置規制され、絞り開口部１３ｂによって小絞り開口形状が決定される。このとき、図３と図５の対応は以下の通りである。

【００４５】

図３	⇔	図５
初期位置	⇔	閉位置
①位置	⇔	絞り開放
③位置	⇔	絞り小絞り

（第２の実施の形態）本実施の形態は、励磁コイルへの通電をパルス通電とするもので、図６は光量調節装置の励磁コイルへの通電波形を示す。

【００４６】図６（ａ）は絞り値設定時の各励磁コイルへの通電波形を示す。このとき、略デューティ（duty）５０％とすると、消費電力は図２に示す矩形波入力の場合と比較して約１／２に低減できる。この時のＰＷＭの周波数は通電電流波形が略直流電流になる周波数で設定する。

【００４７】また、図６（ｂ）は閉じ動作（シャッター動作）時の通電波形を示す。閉じ速度は高速が要求される為、矩形波が最適条件である。

【００４８】（第３の実施の形態）前記実施の形態は各励磁コイルの抵抗値が等しい場合に励磁コイルへの通電入力の条件を最適にするものであるが、更に簡単に実現できる方法として駆動コイルの抵抗を、Ａ励磁コイル＜Ｂ励磁コイル、としておけば、少なくとも絞り値の設定の際の消費電力低下を可能にする。

【００４９】（第４の実施の形態）図７は本発明の第４の実施の形態を示す。

【００５０】図７は前記各実施の形態をデジタルカメラなどの画像記録装置に応用した場合のフローチャートを示す。

【００５１】ＳＴ１０１：電源投入後、モードＳＷが撮影モードか否かを判断する。

【００５２】ＳＴ１０２：撮影モードであれば、絞り駆動回路を図６に示したＰＷＭ駆動に設定する。

【００５３】ＳＴ１０３：絞りを開放に駆動設定する。

【００５４】ＳＴ１０４：カメラに設けられたレリーズボタンを半押しすることによりオンすると露出決定のための動作等を開始させる第１レリーズスイッチがオンしたか否かを判断する。

【００５５】ＳＴ１０５：前記第１レリーズスイッチがオンの場合、マイコンのＲＯＭに予めプログラムされている露出決定処理を実行し、絞りを開放か小絞りかに設定する指示を出す。

【００５６】ＳＴ１０６：絞り開放の指示が出たか否かを判断する。

【００５７】ＳＴ１０７：ＳＴ１０６で（Ｎ）の場合、小絞りに設定する。

【００５８】ＳＴ１０８：絞りが開放の場合あるいはＳＴ１０７で絞りが設定されると、絞り駆動回路を矩形駆動に設定する。

【００５９】ＳＴ１０９：前記レリーズボタンがさらに押されてシャッターレリーズを行なわせる第２レリーズスイッチがオンか否かを判断する。

【００６０】ＳＴ１１０：前記第２レリーズスイッチがオンすると、絞りを閉位置に駆動して保持する。

【００６１】ＳＴ１１１：画像の取り込みを行なう。

【００６２】ＳＴ１１２：画像の取り込みが完了したか否かを判断し、完了していれば、ＳＴ１０１に戻る。

【００６３】

【発明の効果】請求項１～３に係る発明によれば、ステッピングモータの制御入力は、絞り値設定の制御入力が、閉じ動作させる時の制御入力よりも小さくなるように構成したので、絞りの位置検出用のセンサーや検出回路を用いず光量調節を容易に行う事ができる。

【００６４】請求項４、５に係る発明によれば、前記ステッピングモータのコイル抵抗値は、閉じ動作を決定する相のコイル抵抗値が絞り値を決定するもう一方のコイ

ル抵抗値よりも小さいので、絞り値設定時の省エネが図れ、閉じ動作時の高速化が可能となる。

【００６５】また、請求項６に係る発明によれば、前記ステッピングモータの制御入力は、絞り値設定時の通電波形は所定のコイルへＰＷＭ入力とし、閉じ動作時の通電波形は所定のコイルへ矩形波入力としたので、絞り値制御時の省エネが図れ、閉じ動作の高速化が可能となる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態における光量調節装置のステッピングモータの概略図。

【図２】（ａ）（ｂ）は図１に示す光量調節装置の初期位置設定の通電方向を示す図。

【図３】（ａ）（ｂ）（ｃ）は第１の実施の形態の動作説明図

【図４】第１の実施の形態における通電波形を示した図。

【図５】第１の実施の形態における光量調節装置の動作状態を示す図。

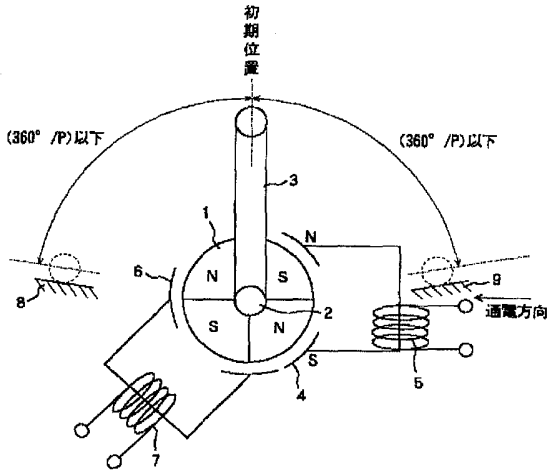
【図６】第２の実施の形態の通電波形を示す図。

【図７】第４の実施の形態を示すフローチャート。

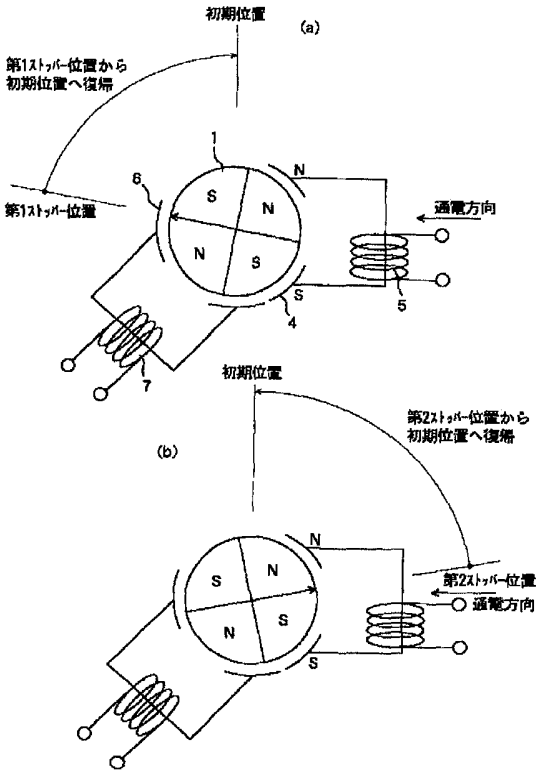
【符号の説明】

１…ロータマグネット
２…回転軸
３，１１…レバー
４…Ａステータ
５…Ａ励磁コイル
６…Ｂステータ
７…Ｂ励磁コイル
８…第１ストッパー
９…第２ストッパー
１０…ステッピングモータ
１２，１６…ストッパー
１３…絞り羽根
１４…絞り開放径
１５…絞り羽根直進ガイド

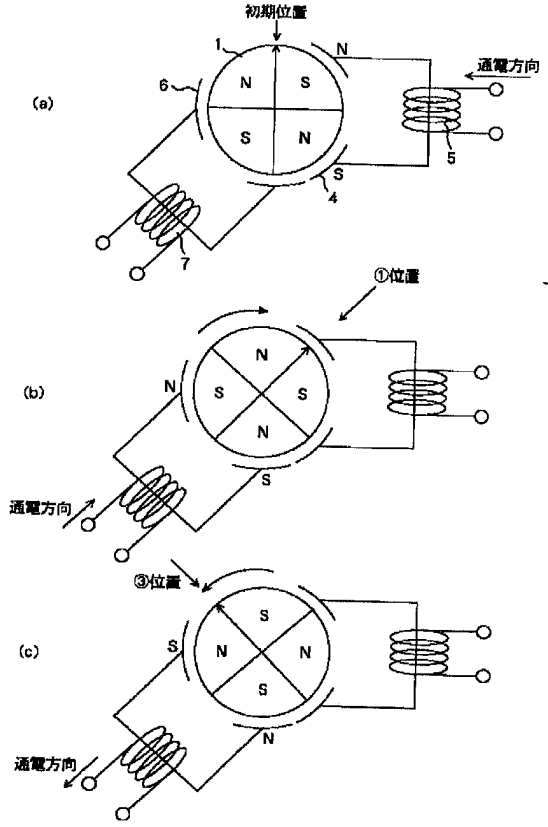
【図１】



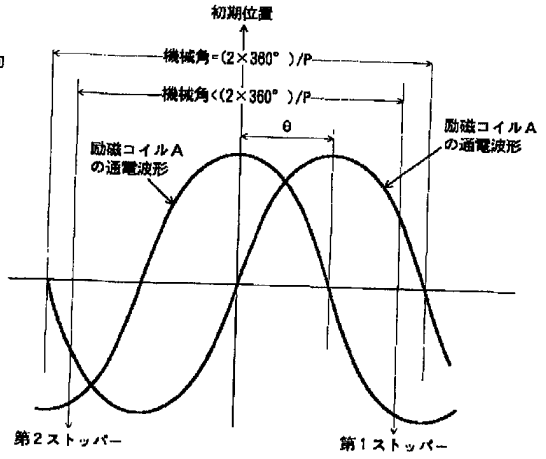
【図２】



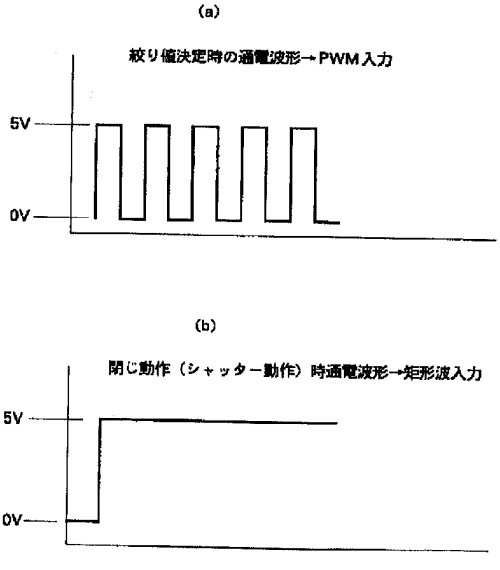
【図３】



【図４】



【図６】



【図５】

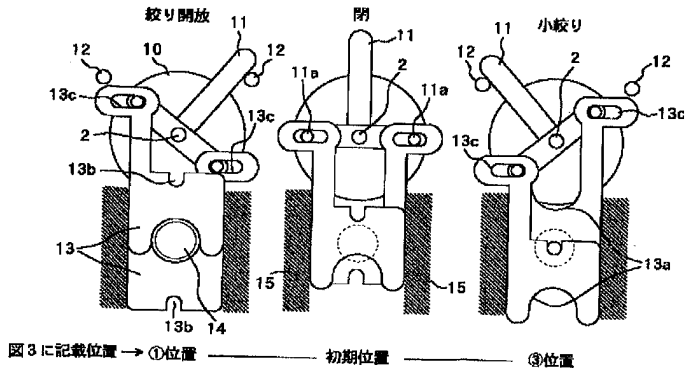
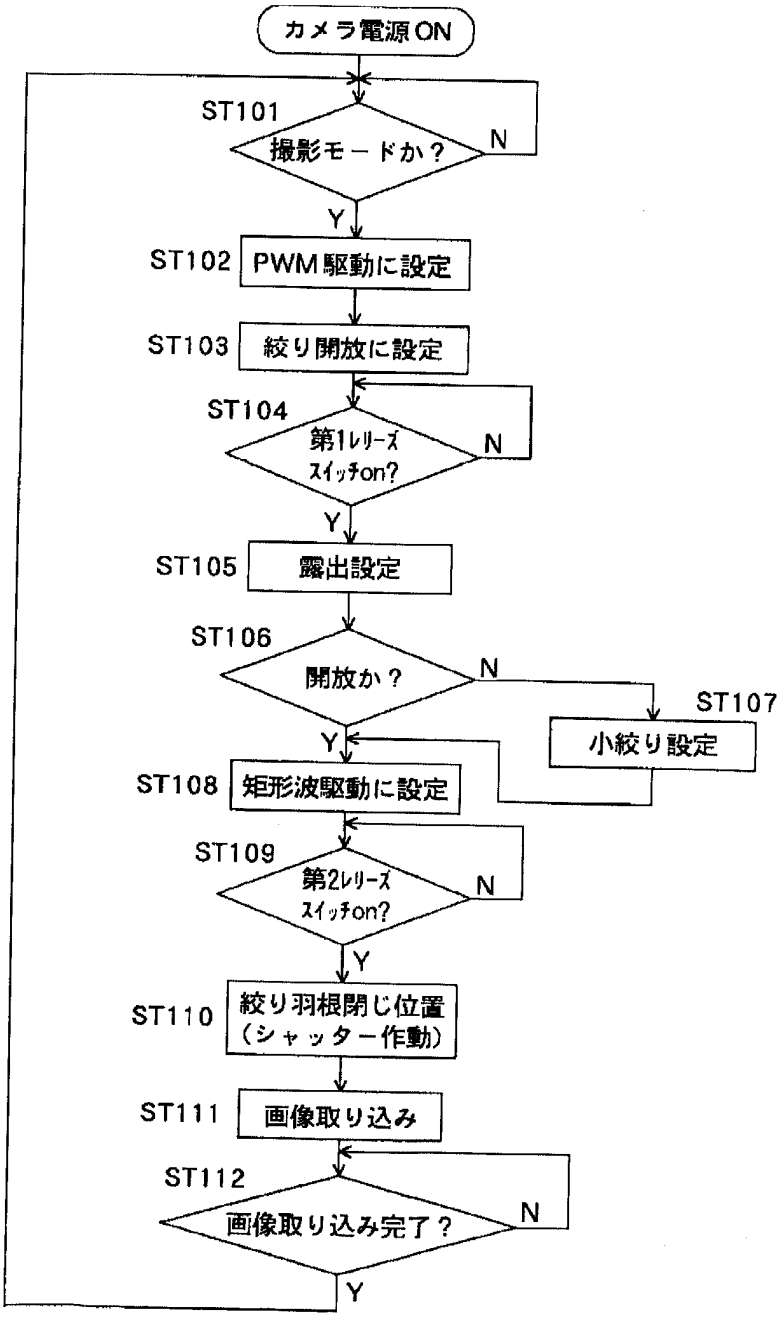


図３に記載位置 → ①位置 ——— 初期位置 ——— ③位置

【図７】


カメラ電源ON
ST101
撮影モードか？
N
Y
ST102
PWM駆動に設定
ST103
絞り開放に設定
ST104
第1レリーズ
スイッチon?
N
Y
ST105
露出設定
ST106
開放か？
N
ST107
小絞り設定
Y
ST108
矩形波駆動に設定
ST109
第2レリーズ
スイッチon?
N
Y
ST110
絞り羽根閉じ位置
（シャッター作動）
ST111
画像取り込み
ST112
画像取り込み完了？
N
Y

CLIPPEDIMAGE= JP02002107792A

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DOCUMENT-IDENTIFIER: JP 2002107792 A

TITLE: LIGHT QUANTITY ADJUSTING DEVICE

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INVENTOR-INFORMATION:

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APPL-NO: JP2000303431

APPL-DATE: October 3, 2000

INT-CL (IPC): G03B009/02;H02P008/12 ;H02P008/00 ;H04N005/238

ABSTRACT:

PROBLEM TO BE SOLVED: To provide a light quantity adjusting device capable of
adjusting the quantity of light without using a sensor or detection circuit for
detecting the position of a diaphragm.

SOLUTION: The light quantity adjusting device is provided with a light quantity
adjusting member, a stepping motor, in which a pair of stators 4, 6 provided
with exciting coils 5, 7 are arranged oppositely to a rotor magnet 1
moltipolar-magnitized on its outer peripheral surface with a phase difference
of an electric angle 90° and by which the adjusting member is opened/closed
by positively/reversely rotating the magnet 1 by allowing an alternate current
to flow through the coils 5, 7, and stoppers 8, 9 for

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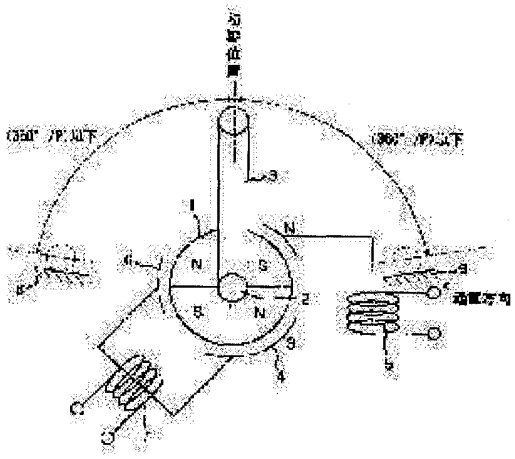
(71)Applicant : **CANON INC**
(72)Inventor : **KAWANISHI TOSHIAKI**

(54) LIGHT QUANTITY ADJUSTING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a light quantity adjusting device capable of adjusting the quantity of light without using a sensor or detection circuit for detecting the position of a diaphragm.
SOLUTION: The light quantity adjusting device is provided with a light quantity adjusting member, a stepping motor, in which a pair of stators 4, 6 provided with exciting coils 5, 7 are arranged oppositely to a rotor magnet 1 moltipolar-magnitized on its outer peripheral surface with a phase difference of an electric angle 90° and by which the adjusting member is opened/closed by positively/reversely rotating the magnet 1 by allowing an alternate current to flow through the coils 5, 7, and stoppers 8, 9 for limiting the mechanical angle of the magnet 1 within a prescribed range with the initial position of the magnet 1 determined by power supply to the prescribed exciting coil as reference. When the number of magnetic poles of the magnet 1 is defined as P, the stoppers 8, 9 are limited so that mechanical angle is less than (2×360°)/P.



LEGAL STATUS

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] As opposed to quantity of light controller material and the Rota magnet which carried out multi-electrode magnetization in the periphery side The stepping motor which has the phase contrast of 90 degrees by the electrical angle, carries out opposite arrangement of the stator of the couple equipped with the exiting coil, right-rotates reversely and carries out the opening-and-closing drive of the aforementioned quantity of light controller material by energizing police box current in each aforementioned coil, With the stopper which restricts the machine angle of the aforementioned Rota magnet within the limits of predetermined on the basis of the initial valve position of the aforementioned Rota magnet determined by the energization to the aforementioned predetermined exiting coil ****** and the aforementioned stopper are a quantity of light adjustment characterized by restricting to the range of machine angle <(2x360 degrees)/P, when the magnetization pole of the aforementioned Rota magnet is set to P.
[Claim 2] The regulation position of both which are regulated by the aforementioned stopper is a quantity of light adjustment according to claim 1 characterized by having considered as the 1st opening position and the 2nd opening position where effective-area products differ, and making the aforementioned initial valve position into a closed position.
[Claim 3] The quantity of light adjustment according to claim 1 or 2 characterized by using one of the aforementioned exiting coils for the aforementioned initial-valve-position setup.
[Claim 4] The resistance of aforementioned one exiting coil is a quantity of light adjustment according to claim 3 characterized by being smaller than the resistance of the exiting coil of aforementioned another side.
[Claim 5] The claim 1 characterized by the control input to aforementioned one exiting coil being smaller than the control input to the exiting coil of aforementioned another side, or the quantity of light adjustment of any one publication of four.
[Claim 6] For the control input of the aforementioned stepping motor, 4 is [the claim 1 characterized by having considered the energization wave at the time of a drawing value setup as the PWM input, and considering the energization wave at the time of closing operation as a square wave input, or] the quantity of light adjustment of a publication either.
[Claim 7] Image recording equipment characterized by having a quantity of light adjustment according to claim 1 to 6.
[Claim 8] The aforementioned image recording equipment is image recording equipment according to claim 7 characterized by being a digital camera.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to image recording equipments, such as a quantity of light adjustment and a digital camera.
[0002]
[Description of the Prior Art] The quantity of light adjustment used for the conventional video camera etc. is widely used as technology in which the thing equipped with the circuit which outputs the control signal of a drawing position is well-known while having the actuator of the GARUBANO method to which switching action of the two drawing wings is carried out with the amount of energization to a drive coil, and a hall device for position detection of drawing.
[0003] Moreover, it is necessary to acquire a high-speed closing operating characteristic by reverse-energizing to a drive coil at the time of shutter operation in the case of picture incorporation.
[0004]
[Problem(s) to be Solved by the Invention] However, in the actuator of the above-mentioned conventional example, there were a hall device for position detection of drawing and a fault which used the hall device output and which the power consumption at the time of the usual drawing value setup also increases although it is necessary to lower the resistance of a drive coil to extracting, and part mark of a circuit, such as a detector of a position and circuit adjustment, being also mostly complicated, and realizing a high-speed shutter.
[0005] Moreover, in such composition, it is difficult to realize energy saving and the small and cheap quantity of light adjustment which are required of a digital still camera etc. in recent years.
[0006] The 1st purpose of invention concerning this application tends to offer the quantity of light adjustment and image recording equipment which can perform quantity of light regulation, without using the sensor and detector for position detection of drawing.
[0007] The 2nd purpose of invention concerning this application tends to aim at energy saving at the time of control of a drawing value, and a drawing setup, and tends to offer the quantity of light adjustment and image recording equipment which enable improvement in the speed of closing operation.
[0008]
[Means for Solving the Problem] As opposed to the Rota magnet which carried out multi-electrode magnetization of the 1st invention with quantity of light controller material in the periphery side The stepping motor which has the phase contrast of 90 degrees by the electrical angle, carries out opposite arrangement of the stator of the couple equipped with the exiting coil, right-rotates reversely and carries out the opening-and-closing drive of the aforementioned quantity of light controller material by energizing police box current in each aforementioned coil, With the stopper which restricts the machine angle of the aforementioned Rota magnet within the limits of predetermined on the basis of the initial valve position of the aforementioned Rota magnet determined by the energization to the aforementioned predetermined exiting coil ****** and the aforementioned stopper are in the quantity of light adjustment characterized by restricting to the range of machine angle <(2x360 degrees)/P, when the magnetization pole of the aforementioned Rota magnet is set to P.
[0009] The 2nd invention is the 1st above-mentioned invention, and it is characterized by having made the regulation position of both which are regulated by the aforementioned stopper into the 1st opening position and the 2nd opening position where effective-area products differ, and making the aforementioned initial valve position a closed position.
[0010] The 3rd invention is invention of one of the above, and is characterized by using one of the aforementioned exiting coils for the aforementioned initial-valve-position setup.
[0011] The 4th invention is the 3rd above-mentioned invention, and the resistance of aforementioned one exiting coil is characterized by being smaller than the resistance of the exiting coil of aforementioned another side.
[0012] The 5th invention is invention of one of the above, and is characterized by the control input to aforementioned one exiting coil being smaller than the control input to the exiting coil of aforementioned another side.
[0013] The 6th invention is the above 1st or one invention of the 4th, and the control input of the aforementioned stepping motor is characterized by having considered the energization wave at the time of a drawing value setup as the PWM input, and considering the energization wave at the time of closing operation as a square wave input.
[0014] The image recording equipment characterized by having one of the above-mentioned quantity of light adjustments has the 7th invention.

[0015] Invention of the octavus is the 7th above-mentioned invention, and it is characterized by the aforementioned image recording equipment being a digital camera.
[0016]
[Embodiments of the Invention] (Gestalt of the 1st operation) The principle of operation of the quantity of light adjustment in the gestalt of the 1st operation applied to this invention at drawing 1 or drawing 5 is shown. In drawing 1 , they are the cylindrical shape-like Rota magnet with which 1 [four-pole] was magnetized by the periphery side, the axis of rotation which 2 fixed to the Rota magnet 1, and the lever which 3 fixes to the axis of rotation 2, and circles with the Rota magnet 1.
[0017] The electromagnet which are A stator from which 4 becomes one magnetic pole of an electromagnet, A exiting coil which 5 excites [exiting coil] the A stator 4 and generates magnetism, B stator from which 6 becomes the magnetic pole of another electromagnet, and B exiting coil which 7 excites [exiting coil] the B stator 6 and generates magnetism, and is constructed [above-mentioned] two is arranged with the phase contrast of 90 degrees by the electrical angle.
[0018] That is, PM type stepping motor of two phases which the Rota magnet 1 rotates synchronizing with the rotating magnetic field generated by passing the police box current which has the phase contrast of 90 degrees to the A exiting coil 5 and the B exiting coil 7 is constituted.
[0019] 8 and 9 are the 1st stopper and the 2nd stopper which restrict the machine angle of the Rota magnet 1 to the range of machine angle <180 degree the following (/(2x360 degrees) P) on the basis of the initial state when energizing in the direction of <- to the A exiting coil 5 since it is P= 4.
[0020] Drawing 2 (a) shows operation which can be set as an initial valve position from the position of the 1st stopper 8 and the 2nd stopper 9 by energizing in the direction of <- to the A exiting coil 5. Here, it substitutes for the physical relationship to which a lever 3 contacts the 1st stopper 8 and the 2nd stopper 9 with the arrow illustrated to the Rota magnet 1. In addition, it should move to the 1st stopper position shown in (a) of drawing 2 , and the 2nd stopper position shown in (b) by energization of the driving signal to for example, A exiting coil or B exiting coil, and energization should be stopped in the position.
[0021] If a lever 3 energizes in the direction of -> to the A exiting coil 5 in the state of being in contact with the 1st stopper 8, as the magnetic pole of the A stator 4 shows drawing 2 (a), N and the south pole are magnetized, and turning effort will arise in the hand of cut of illustration, and it will return to an initial state.
[0022] This relation is the same, when returning to an initial state from the state where the lever 3 is in contact with the 2nd stopper 9, as shown in drawing 2 (b).
[0023] Therefore, if the machine angle of the Rota magnet 1 regulated by the 1st stopper 8 and the 2nd stopper 9 becomes more than [(2x360 degrees)/P] Even if it energizes in the direction of -> to the A exiting coil 5, the turning effort of the direction which returns to an initial state is not produced from the 1st stopper 8 and the 2nd stopper 9, but since turning effort arises to an opposite direction, it is necessary to make below into [(2x360 degrees)/P] the machine angle of the Rota magnet 1 shown in the form of this operation.
[0024] Drawing 3 shows operation which sets up the rotation position of the Rota magnet 1, respectively by energization to A and the B exiting coils 5 and 7 from an initial state.
[0025] Drawing 3 (a) -> drawing 3 (b)
As mentioned above, if it energizes in the direction (the 1st direction) of <- to the A exiting coil 5, the Rota magnet 1 will return to an initial valve position.
[0026] Next, if energization of the A exiting coil 5 is turned OFF while energizing in the direction (the 2nd direction) of <-, as shown in the B exiting coil 7 at drawing 3 (b), the Rota magnet 1 will rotate in the direction of an arrow (right) of drawing 3 (b), and will stop in the position shown by ** which the magnetic pole of the B stator 6 and the magnetic pole of the Rota magnet 1 countered.
[0027] Drawing 3 (a) -> drawing 3 (c)
In order to return the Rota magnet 1 to an initial valve position, as mentioned above, it energizes in the direction (the 1st direction) of <- to the A exiting coil 5.
[0028] Next, if energization to the A exiting coil 5 is turned OFF while energizing in the direction (the 2nd direction and opposite direction) of -> to the B exiting coil 7 as shown in drawing 3 (c), the Rota magnet 1 will rotate in the direction of an arrow (left) of drawing 3 (c), and will stop in the position shown in ** which the magnetic pole of the B stator 6 and the magnetic pole of the Rota magnet 1 countered.
[0029] That is, if position regulation of an angle of rotation is prepared in the range narrower than the position shown in **, and the position shown in **, the position of three positions can be determined only on the energization conditions of A and the B exiting coils 5 and 7.
[0030] With the gestalt of the 1st operation shown in drawing 1 - drawing 3 , although 1 phase excitation explains energization of an exiting coil, if it is performed by 1-2 phase excitation, a halt position can be increased further easily.
[0031] Drawing 4 shows the energization wave when making A of the stepping motor of two phases, and the control input of the B exiting coils 5 and 7 into the micro step driving input by the false sine wave.
[0032] The initial valve position of a lever 3 is a time of B exiting coil serving as SIN100% of input.
[0033] It is A exiting-coil =SIN (theta-90) about the ratio of the amount of energization of the A exiting coil 5 and the B exiting coil 7 so that the energization wave of drawing may show, in order to do theta** rotation of by the electrical angle to an initial valve position.
B exiting coil = SIN (theta)

If it is set as the ratio come out of and called for, abbreviation control of the halt position of a lever 3 can be carried out.
[0034] Moreover, what is necessary is to choose the number of partitions of a micro step drive wave according to the busy condition of a device, and just to determine it.
[0035] Drawing 5 is an outline block diagram at the time of applying to a quantity of light adjustment corresponding to explanation of drawing 3 of operation.
[0036] In drawing 5 , 10 is the stepping motor of two phases, 11 is the lever which fixes to the axis of rotation 2 of a stepping motor 10, and, as for a stepping motor 10, a rotation position is regulated with two stoppers 12 and levers 11 which are prepared in the stepping motor 10.
[0037] The above-mentioned position regulation range is set as above-mentioned machine angle < [(2x360 degrees)/P].
[0038] The energization input of a stepping motor 10 is supplied to A and the B exiting coils 5 and 7 from terminal 10a, and since the energization method is the same as that of the above-mentioned, detailed explanation is omitted.
[0039] It has fixed by the axis of rotation 2, pressing fit, or adhesion of a stepping motor 10 etc., and heights 11a of the lever 11 which protruded on right and left of the axis of rotation 2 is being engaged in two long slot 13c which protruded on each shoulder of one pair of drawing wings 13 displaced relatively, and when a lever 11 rotates, a lever 11 is extracted along with the rectilinear-propagation move guide 15, and can be made to carry out attitude movement of wing 13 the very thing.
[0040] A closed state determines the state of an initial valve position according to the energization conditions which a stepping motor 10 shows to drawing 3 (a) of A exiting coil.
[0041] Next, it extracts according to the energization conditions shown in drawing 3 (b) of the B exiting coil 7, and (c), and an open state or a small drawing state is determined.
[0042] A lever 11 rotates counterclockwise, position regulation is carried out by the stopper 12, and drawing opening sets up an open state with the diameter 14 of drawing opening of a non-illustrated optical instrument, when it extracts according to the energization conditions shown in drawing 3 (b) and a wing 13 carries out open operation.
[0043] At this time, opening of opening 13a of the drawing wing 13 is extracted, and serves as a major diameter from the diameter 14 of opening.
[0044] It extracts as drawing opening, and a lever 11 rotates clockwise according to the energization conditions shown in drawing 3 (c), position regulation of the drawing state between close by-pass bulb completelies (small drawing) is carried out by the stopper 12, and a small drawing opening configuration is determined by drawing opening 13b. At this time, the correspondence of drawing 3 and drawing 5 is as follows.
[0045]
drawing 3 [ ] <=> Drawing 5 initial valve position <=> Closed-position ** position <=> Drawing opening ** position <=>
The gestalt of drawing smallness drawing (gestalt of the 2nd operation) book operation considers energization to an exiting coil as pulse energization, and drawing 6 shows the energization wave to the exiting coil of a quantity of light adjustment.
[0046] Drawing 6 (a) shows the energization wave to each exiting coil at the time of a drawing value setup. the case of the square wave input which shows power consumption to drawing 2 at this time when abbreviation duty (duty) 50% -- comparing -- about -- it can decrease to one half The frequency of PWM at this time is set up on the frequency from which energization current wave type becomes an abbreviation direct current.
[0047] Moreover, drawing 6 (b) shows the energization wave at the time of closing operation (shutter operation). Since high speed is required, the square wave of closing speed is optimum conditions.
[0048] (Gestalt of the 3rd operation) As a method of realizing still more easily, although the gestalt of the aforementioned implementation makes the optimal the conditions of the energization input to an exiting coil when the resistance of each exiting coil is equal, if resistance of a drive coil is made into the A exiting-coil <B exiting coil, it will be extracted at least and will enable the power consumption fall in the case of a setup of a value.
[0049] (Gestalt of the 4th operation) Drawing 7 shows the gestalt of operation of the 4th of this invention.
[0050] Drawing 7 shows the flow chart at the time of applying the gestalt of each aforementioned implementation to image recording equipments, such as a digital camera.
[0051] ST101: Mode S W judges whether it is photography mode after powering on.
[0052] ST102: If it is photography mode, it will be set as the PWM drive which showed the drawing drive circuit to drawing 6 .
[0053] ST103: Carry out a drive setup of the drawing at opening.
[0054] ST104: If turned on by half-push [the release button prepared in the camera], it will judge whether the 1st release switch which makes operation for exposure determination etc. start turned on.
[0055] ST105: When the aforementioned 1st release switch is ON, perform exposure determination processing currently beforehand programmed by ROM of a microcomputer, and issue the directions which set drawing to opening or small drawing.
[0056] ST106: Judge whether directions of drawing opening came out.
[0057] ST107: In the case of (N), set it as small drawing by ST106.
[0058] ST108: If drawing is set up by ST107 when drawing is opening or, a drawing drive circuit will be set as a rectangle drive.
[0059] ST109: The 2nd release switch on which the aforementioned release button is further pushed on and shutter release is made to perform judges whether it is ON.
[0060] ST110: ON of the aforementioned 2nd release switch drives and holds drawing to a closed position.

[0061] ST111: Perform incorporation of a picture.
[0062] ST112: If it judged whether the incorporation of a picture was completed and has completed, it will return to ST101.
[0063]
[Effect of the Invention] According to invention concerning claims 1-3, since the control input of a drawing value setup constituted the control input of a stepping motor so that it might become smaller than the control input when carrying out closing operation, it can perform quantity of light regulation easily not using the sensor and detector for position detection of drawing.
[0064] According to invention concerning claims 4 and 5, since it is smaller than another [which the coil resistance of the phase which determines closing operation extracts, and determines a value] coil resistance, the coil resistance of the aforementioned stepping motor can aim at energy saving at the time of a drawing value setup, and becomes accelerable [at the time of closing operation].
[0065] Moreover, according to invention concerning a claim 6, since the control input of the aforementioned stepping motor considered the energization wave at the time of a drawing value setup as the PWM input to the predetermined coil and considered the energization wave at the time of closing operation as the square wave input to the predetermined coil, it can aim at energy saving at the time of drawing value control, and becomes accelerable [closing operation].

[Translation done.]

EFFECT OF THE INVENTION

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[0064] According to invention concerning claims 4 and 5, since it is smaller than another [which the coil resistance of the phase which determines closing operation extracts, and determines a value] coil resistance, the coil resistance of the aforementioned stepping motor can aim at energy saving at the time of a drawing value setup, and becomes accelerable [at the time of closing operation].

[0065] Moreover, according to invention concerning a claim 6, since the control input of the aforementioned stepping motor considered the energization wave at the time of a drawing value setup as the PWM input to the predetermined coil and considered the energization wave at the time of closing operation as the square wave input to the predetermined coil, it can aim at energy saving at the time of drawing value control, and becomes accelerable [closing operation].

[Translation done.]